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(71) Applicant(s)
Telefonaktiebolaget L M Ericsson
(incorporated in Sweden)
SE-126 25, Stockholm, Sweden

(72) Inventor(s)
Timo Ågåll

(74) Agent and/or Address for Service
Marks & Clerk
4220 Nash Court, Oxford Business Park South,
OXFORD, OX4 2RU, United Kingdom

(54) Abstract Title
Signalling gateway redundancy

(57) A method of routing signalling messages in a signalling gateway 4 disposed between an SS7 signalling network 1 and one or more Media Gateway Controllers (MGCs) 3 of an IP based network 2, the method comprising the steps of receiving a signalling message from the SS7 network 1 and examining the Destination Point Code (DPC) of the message. If the DPC matches a predefined Paint Code (PC) or one of a set of predefined PCs allocated to said MGC(s) 3 and differs from the PC(s) allocated to the signalling gateway 4, the IP address of the destination MGC 3 is identified and the signalling message forwarded to the MGC 3 using the IP address.

An independent claim to a MGC 3 connected to a number of signalling gateways 4 is included.

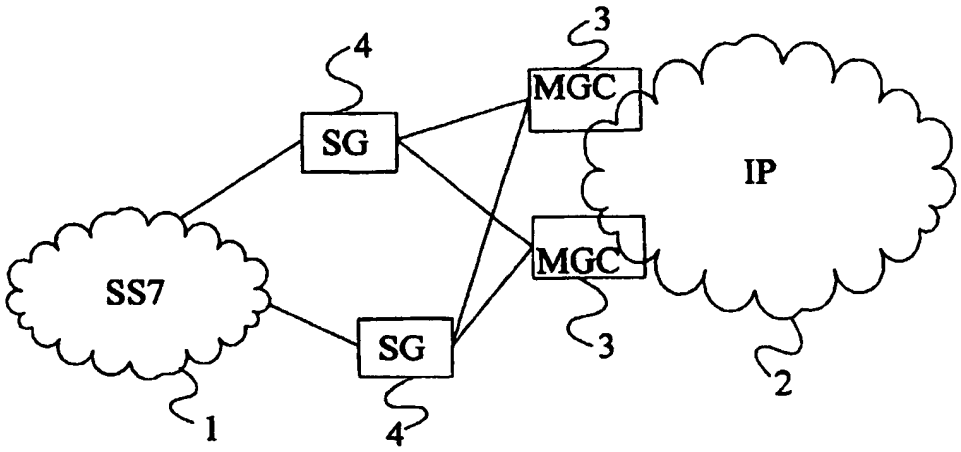

Figure 1

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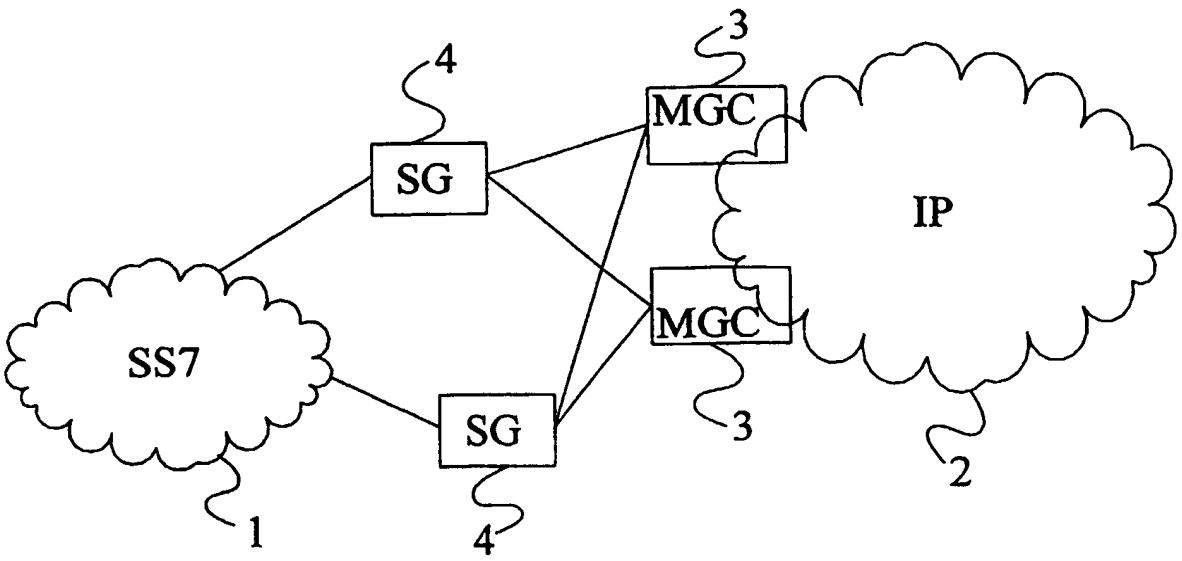

Figure 1

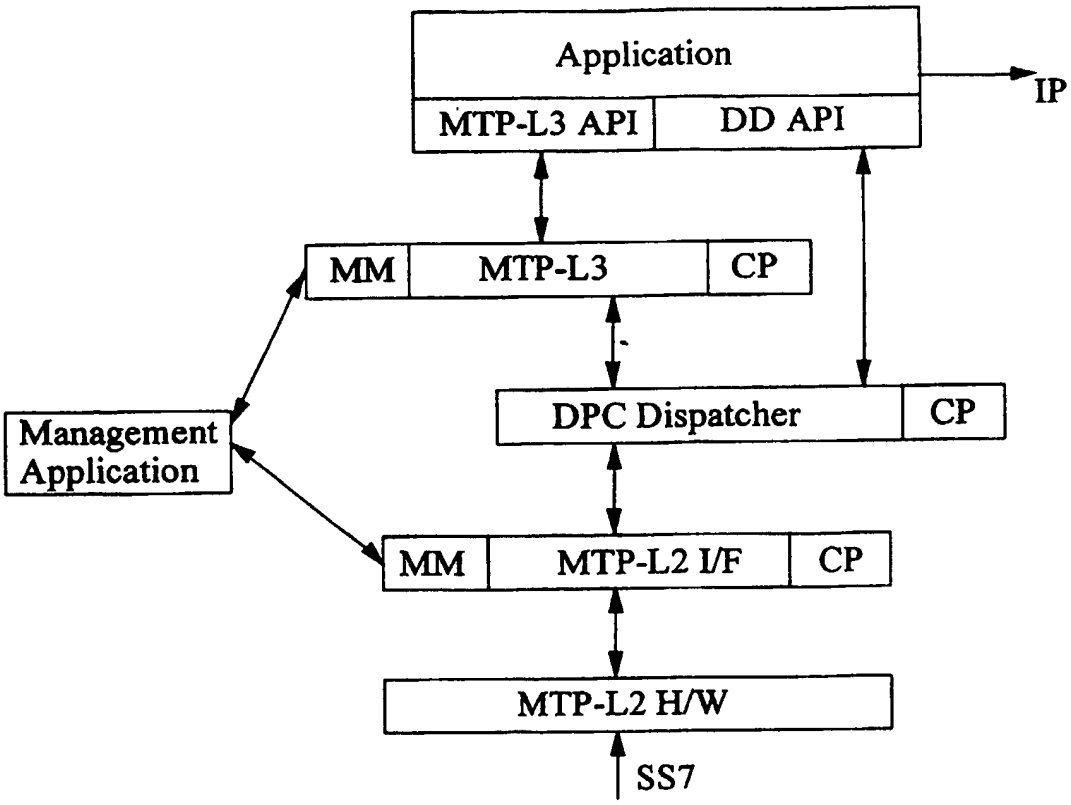
Application
IP
MTP-L3 API
DD API
MM
MTP-L3
CP
DPC Dispatcher
CP
Management Application
MM
MTP-L2 I/F
CP
MTP-L2 H/W
SS7

Figure 2

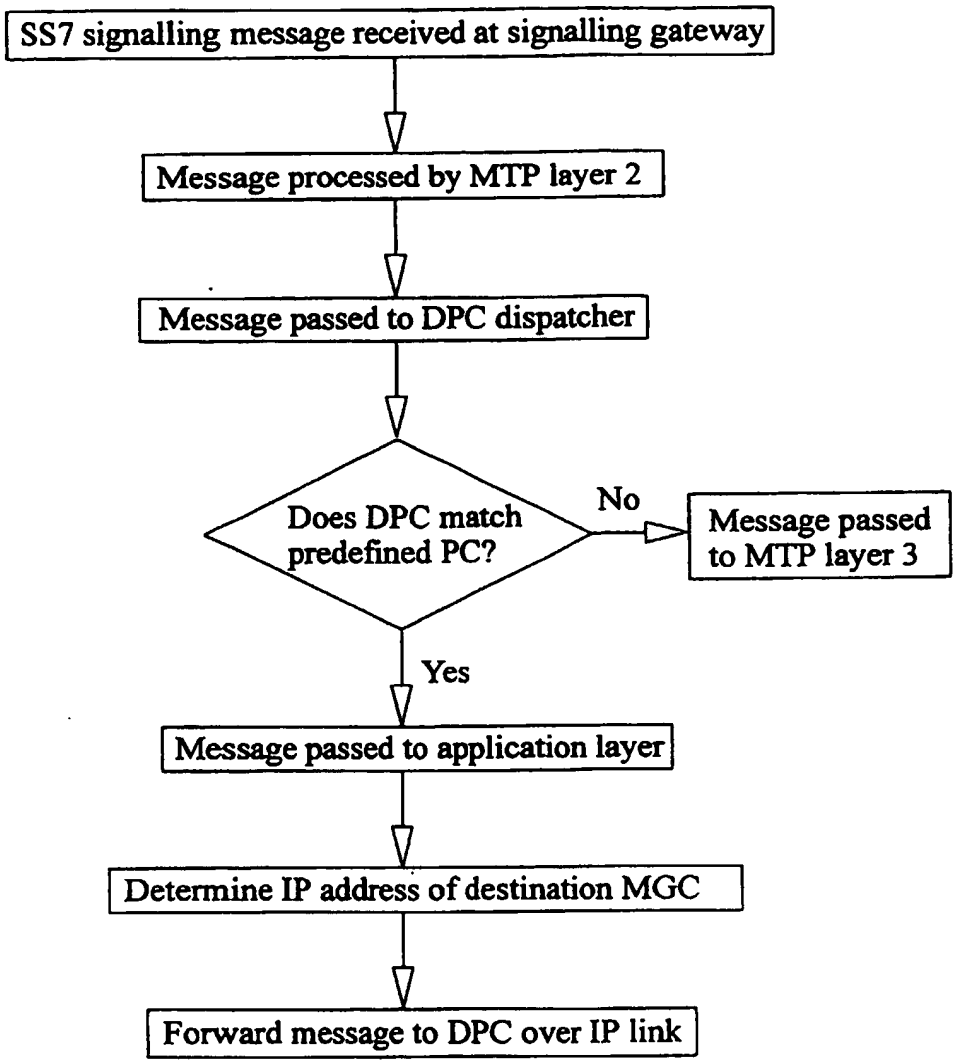
SS7 signalling message received at signalling gateway
Message processed by MTP layer 2
Message passed to DPC dispatcher
Does DPC match predefined PC?
No
Message passed to MTP layer 3
Yes
Message passed to application layer
Determine IP address of destination MGC
Forward message to DPC over IP link

Figure 3

Signalling Gateway Redundancy

Field of the Invention

The present invention relates to signalling gateway redundancy and more particularly to such redundancy as will increase the robustness of a signalling network employing signalling gateways.

Background to the Invention

Telecommunications networks currently rely to a large extent upon Signalling System No.7 (SS7) as the mechanism for controlling call connections and for handling the transfer of signalling information between signalling points of the networks. Typically, one or more application and user parts at a given signalling point will make use of SS7 to communicate with peer application and user parts at some other signalling point. Examples of user parts are ISUP (ISDN User Part) and TUP (Telephony User Part) whilst examples of application parts are INAP (Intelligent Network Application Part) and MAP (Mobile Application Part). The conventional SS7 protocol stack includes Message Transfer Parts MTP1, MTP2, and MTP3 which handle the formatting of signalling messages for transport over the physical layer as well as various routing functions. Both signalling and user data is carried over Synchronous Transfer Mechanism (STM) networks using either the E.1 (Europe) or T.1 (USA) systems. In some cases a common STM network is used for both signalling and user data whilst in other cases separate STM networks are used.

There has been considerable interest of late amongst the telecommunications industry in using non-conventional (at least within the telecommunications industry) signalling and user data transport mechanisms in telecommunications networks in place of the conventional mechanisms. The reasons for this are related both to improvements in efficiency as well as potential cost savings. Much consideration has been given for example to the use of Internet Protocol (IP) networks to transport signalling and user data between network nodes. IP networks have the advantage that they make efficient use of transmission resources by using packet switching and are relatively low in cost

due to the widespread use of the technology (as opposed to specialised telecommunication technology). There is also interest in using other transport mechanisms including ATM (AAL1/2/5), FR etc.

In any practical system, IP based signalling networks must be interoperable with SS7 networks. This requires the use of signalling gateways which convert signalling messages from SS7 format to a format suitable for transmission over an IP connection and *vice versa*. In a typical scenario, a signalling gateway would be connected on one side to a SS7 network of a Public Switched Telephone Network (PSTN) and on the other side to one or more media gateway controllers (MGCs) via an IP connection. The MGCs are arranged to control media gateways at the bearer level for setting up and controlling user connections. MGCs are connected to one another via an IP network.

As it is the MGCs which are responsible for user connections, and signalling gateways are little more than intelligent interfaces, it will be appreciated that the final destination points, or points of origin, for signalling messages are MGCs. Signalling messages are routed in an SS7 network on the basis of Point Codes (PCs) allocated to signalling points and incorporated into message headers. Messages may be routed via intermediate Signalling Points known as Signalling Transfer Points (STPs). It is the MTP3 layer of a signalling point which is responsible for examining the Destination Point Code (DPC) of received messages and either routing the message to another signalling point (if the DPC is not the local PC) or passing the message to an application at the signalling point (if the DPC is the local PC). Signalling gateways are allocated unique DPCs within a SS7 network. Signalling messages destined for a given MGC include the DPC of the corresponding signalling gateway. A signalling gateway forwards messages to a MGC using the IP address of that MGC, the IP address being identified using a combination of Service Identifier (SI), Network Identifier (NI), the DPC, the Originating Point Code (OPC), and possibly a Circuit Identification Code (CIC), all of which are contained in the signalling message received from the SS7 network.

Summary of the Invention

Faults can and do occur in signalling links of an SS7 network. Links may also become congested where the volume of signalling traffic is high. There is therefore a need to include a level of redundancy in SS7 networks so as to allow for several different signalling routes between a given pair of signalling points. It will be appreciated however that because signalling gateways represent end points from the point of view of an SS7 network, no redundancy can be introduced. If a signalling gateway becomes unavailable, it is not possible to send signalling messages to a MGC via an alternative route.

It is an object of the present invention to overcome or at least mitigate this problem. This and other objects are achieved at least in part by modifying the standard behaviour of the MTP such that a signalling gateway is seen from an SS7 network as a Signalling Transfer Point.

According to a first aspect of the present invention there is provided a method of signalling in a communications system comprising an SS7 signalling network and an IP network having a plurality of Media Gateway Controllers (MGCs), each MGC being coupled to the SS7 network by at least one signalling gateway, the method comprising defining said signalling gateways in the SS7 network as Signalling Transfer Points (STPs) for messages destined for associated MGCs.

MGCs are allocated SS7 PCs which are different from the PCs allocated to associated signalling gateways. A signalling gateway filters received signalling messages to identify messages containing as their Destination Point Codes (DPCs), Point Codes corresponding to associated MGCs. IP addresses for destination MGCs are identified so that the messages can be forwarded. IP addresses may be identified by mapping *inter alia* DPCs to IP addresses. Mapping may also or alternatively use Service Identifiers, Network Identifiers, Circuit Identification Codes, and Originating Point Codes.

According to a second aspect of the present invention there is provided a method of routing signalling messages in a signalling gateway disposed between an SS7 signalling network and one or more Media Gateway Controllers (MGCs) of an IP based network, the method comprising the steps of:

receiving a signalling message from the SS7 network, the message containing a Destination Point Code (DPC) which is not a Point Code (PC) of the signalling gateway; and

examining the Destination Point Code (DPC) of the message and, if the DPC matches a predefined PC or one of a set of predefined PCs allocated to said MGC(s), mapping the DPC to an IP address of the MGC and forwarding the signalling message to the MGC using the IP address.

Embodiments of the present invention differ from current signalling gateway routing solutions in so far as current solutions treat the signalling gateways as signalling end points. Thus, a signalling message destined for a MGC can only be routed to the MGC via a single signalling gateway.

Preferably, the method of the invention comprises filtering received signalling messages according to their DPCs to identify packets having a predefined PC or one of a set of predefined PCs. More preferably, this filtering step is carried out following processing of the messages by the MTP layers 1 and 2, but prior to processing by the MTP layer 3. (Filtering may alternatively be carried out at the MTP layer 3.) In the event that the DPC of a signalling message matches a predefined PC or one of a set of predefined PCs, the filter passes the signalling message to a control application which identifies an IP address of the destination MGC and forwards the signalling message to the MGC using the IP address. In the event that the DPC of a signalling message does not match a predefined PC or one of a set of predefined PCs, the filter may pass the signalling message to the MTP layer 3.

According to a third aspect of the present invention there is provided a signalling gateway for coupling an SS7 network to one or more Media Gateway Controllers (MGCs) of an IP based network, the signalling gateway comprising:

input means for receiving a signalling message from the SS7 network; and

processing means for examining the Destination Point Code (DPC) of the message and, if the DPC matches a predefined PC or one of a set of predefined PCs associated with said MGC(s) and differs from the PC(s) allocated to the signalling gateway, determining an IP address of a destination MGC; and

output means for forwarding the signalling message to the destination MGC using the IP address.

According to a fourth aspect of the present invention there is provided a method of routing signalling messages from a signalling point of an SS7 signalling network to a Media Gateway Controller (MGC) of an IP network, wherein the SS7 signalling point and the MGC are coupled via a plurality of signalling gateways, the method comprising routing the signalling message via a first signalling gateway representing a primary signalling route if that route is available, otherwise routing the signalling message via a second signalling gateway representing a secondary signalling route.

Brief Description of the Drawings

Figure 1 illustrates schematically a telecommunications signalling system;
Figure 2 illustrates signalling protocol layers at a signalling gateway of the network of Figure 1; and
Figure 3 is a flow diagram illustrating a method of routing signalling messages at the signalling gateway of Figure 2.

Detailed Description of a Preferred Embodiment

There is illustrated in Figure 1 a signalling network of a telecommunications system. In the interest of simplicity, the bearer level of the system is not illustrated in Figure 1. A conventional SS7 signalling network is illustrated by the cloud 1. As will be well understood, the SS7 network 1 comprises a multiplicity of signalling points (SPs) from which signalling messages may originate and where signalling messages may terminate. Each SP implements the standard SS7 protocol stack on top of which sits the user applications (for example ISUP, MAP, TCAP, etc). More particularly, the SS7 stack comprises a Message Transport Part layers 1 to 3. Of these, MTP layer 3 is responsible for routing messages using Point Codes (DPCs) which are permanently allocated to SPs. SPs known as Signalling Transfer Points may be used as intermediate routing nodes.

Figure 1 illustrates an IP network 2 which may be a network owned by an operator who is different from the operator of the SS7 network 1. The role of the IP network 2 is substantially the same as that of the SS7 network 1, i.e. to convey signalling information for the purpose of setting up and controlling user connections at the bearer level. The IP network uses Media Gateway Controllers (MGCs) 3 to control Media Gateways at the bearer level (and between which user connections extend). Signalling messages are exchanged between MGCs over the IP network 2. In order to establish a user connection which extends across the boundary between the bearer networks of the different operators, it is necessary to transport signalling messages (for example a call setup message) between the SS7 and IP networks. This is achieved using signalling gateways 4. Each MGC 3 is connected to two or more different signalling gateways 4 via an IP link (this link may in practice form part of the IP network 2).

Each signalling gateway 4 is allocated one or more Point Codes (PCs) which are unique within the SS7 network. The signalling gateway PCs are recorded by other SPs and STPs of the SS7 network 1. The MTP layer 3 of a SP employs a look-up process to identify a Point Code for a signalling message generated by an application at the SP. The look-up may be carried out using a global title. The identified PC is referred to as the Destination Point Code (DPC) and is included in a message header. SPs route messages on the basis of routing tables which identify possible and preferred signalling links via which messages may be routed. The MGCs 3 are each allocated an SS7 PC (although in some cases a PC may be allocated to a group of MGCs). As far as the routing tables of the SS7 network are concerned, the MGCs 3 look like standard signalling end points whilst the signalling gateways 4 are either STPs or signalling end points (depending upon the DPC).

Figure 2 illustrates a number of protocol layers of a signalling gateway 4. These include the standard MTP layer 2 (L2) which is implemented in hardware, a MTP layer 2 interface (I/F), and a MTP layer 3. Both the MTP layer 2 I/F and the MTP layer 3 are controlled by a management application. Above the MTP layer 3 is the SG application layer (where a MTP layer 3 Application Programming Interface interfaces the MTP layer 3 to the SG application).

Disposed between the MTP layer 2 and the MTP layer 3 is a DPC Dispatcher which is allocated a unique module id within the signalling gateway 3 to enable it to receive messages from the application layer and the MTP layer 2. This Dispatcher effectively filters received SS7 messages ("DL_MSUs") received from the MTP layer 2 to identify whether or not the messages contain as their DPC one of a set of PCs allocated to respective MGCs 3 coupled to the signalling gateway 4. If the DPC of a message is not one of the allocated PCs, the DPC dispatcher passes the message to the MTP layer 3 which handles the message in the normal manner (the MTP layer 3 may identify the DPC as the PC of the signalling gateway 4, in which case the signalling gateway is the end point for the message - this may occur when the signalling message is a maintenance message). If on the other hand the Dispatcher identifies the DPC of a received message as corresponding to one of the PCs allocated to an associated MGC, the message is converted into a "DD_TRANSFER_ind" message and is passed to the application layer via a "DD API".

The application layer is arranged to receive DD_TRANSFER_ind messages and to identify the IP address of the destination MGC 3. For this purpose, the application makes use of a mapping table which may have the following form, where the MGC IP addresses are contained in column 6, and NI represents Network Identifier, SI represents Service Identifier, OPC represents Originating Point Code, DPC represents Destination Point Code, and CIC represents Circuit Identification Code:

NI(2)	SI(5)	OPC(1)	DPC(a)	CIC range(1)	MGC(1, here will be the IP address of the MGC)
...	...	...	...	CIC range(2)	MGC(2)
...	...	...	...	CIC range(n)	MGC(n)
...	...	...	DPC(b)	CIC range(1')	MGC(1')
...	...	...	...	CIC range(2')	MGC(2')
NI(2)	SI(5)	OPC(2)	DPC(a')	CIC range(1)	MGC(1)
...	...	...	...	CIC range(2)	MGC(2)
...	...	...	...	CIC range(n)	MGC(n)

It is noted that the value of SI is always 5 for ISUP whilst the value of NI is usually 2 for national networks. When an IP address is identified, the application layer forwards the message to that IP address over the IP link.

Given that MGCs 3 are each coupled to two (or more) signalling gateways 4, and that the signalling gateways 4 operate like STPs for messages destined for MGCs, it is possible for signalling messages to be routed to a given MGC 3 via one of a number of different routes. For example, in the event that a signalling link to one signalling gateway 4 goes down, or that signalling gateway 4 is congested, a signalling point in the SS7 network is able to send the messages to a different signalling gateway 4. This of course depends upon appropriate routing information being recorded at SS7 signalling points.

Figure 3 is a flow diagram further illustrating the routing mechanism used in a signalling gateway.

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiment without departing from the scope of the present invention.

Claims

1. A method of signalling in a communications system comprising an SS7 signalling network and an IP network having a plurality of Media Gateway Controllers (MGCs), each MGC being coupled to the SS7 network by at least one signalling gateway, the method comprising defining said signalling gateways in the SS7 network as Signalling Transfer Points (STPs) for messages destined for associated MGCs.

2. A method according to claim 1, wherein MGCs are allocated SS7 PCs which are different from the PCs allocated to associated signalling gateways and a signalling gateway filters received signalling messages to identify messages containing as their Destination Point Codes (DPCs), Point Codes corresponding to associated MGCs.

3. A method according to claim 2 and comprising identifying IP addresses for destination MGCs so that the messages can be forwarded.

4. A method of routing signalling messages in a signalling gateway disposed between an SS7 signalling network and one or more Media Gateway Controllers (MGCs) of an IP based network, the method comprising the steps of:

receiving a signalling message from the SS7 network, the message containing a Destination Point Code (DPC) which is not a Point Code (PC) of the signalling gateway; and

examining the Destination Point Code (DPC) of the message and, if the DPC matches a predefined PC or one of a set of predefined PCs allocated to said MGC(s), mapping the DPC to an IP address of the MGC and forwarding the signalling message to the MGC using the IP address.

5. A method according to claim 4 and comprising filtering received signalling messages according to their DPCs to identify packets having a predefined PC or one of a set of predefined PCs.

6. A method according to claim 5, wherein the filtering step is carried out following processing of the messages by the MTP layers 1 and 2, but prior to processing

by the MTP layer 3, and, in the event that the DPC of a signalling message matches a predefined PC or one of a set of predefined PCs, the filter passes the signalling message to a control application which identifies an IP address of the destination MGC and forwards the signalling message to the MGC using the IP address and, in the event that the DPC of a signalling message does not match a predefined PC or one of a set of predefined PCs, the filter passes the signalling message to the MTP layer 3.

7. A method according to claim 5, wherein the filtering step is carried out in MTP layer 2 or layer 3.

8. A signalling gateway for coupling an SS7 network to one or more Media Gateway Controllers (MGCs) of an IP based network, the signalling gateway comprising:

input means for receiving a signalling message from the SS7 network; and

processing means for examining the Destination Point Code (DPC) of the message and, if the DPC matches a predefined PC or one of a set of predefined PCs associated with said MGC(s) and differs from the PC(s) allocated to the signalling gateway, determining an IP address of a destination MGC; and

output means for forwarding the signalling message to the destination MGC using the IP address.

9. A method of routing signalling messages from a signalling point of an SS7 signalling network to a Media Gateway Controller (MGC) of an IP network, wherein the SS7 signalling point and the MGC are coupled via a plurality of signalling gateways, the method comprising routing the signalling message via a first signalling gateway representing a primary signalling route if that route is available, otherwise routing the signalling message via a second signalling gateway representing a secondary signalling route.

The Patent Office

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Application No: GB 0020802.5 **Examiner:** Daniel Voisey
Claims searched: 1 to 8 **Date of search:** 8 March 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4K (KTA)

Int Cl (Ed.7): H04L 12/66, 29/06; H04Q 3/00

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A, E	WO 00/65785 A1	(TEKELEC) see page 5 line 23 to page 6 line 7 and figure 3.	
A, E	WO 01/49045 A2	(ERICSSON) see page 3 paragraph 3 to page 5 paragraph 3.	
A, E	WO 01/86970 A2	(SS8) see abstract	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.